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FAA-2001-10428-7



DEPT. OF TRANSPORTATION

United Parcel Service

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Louisville, KY 40223  
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February 5, 2002 02 FEB -5 PM 1:35

Department of Transportation  
Docket Management System  
Room PL 401  
Washington, DC 20591-0001

- References: 1. Boeing letter dated May 22, 2001 to Office of Rulemaking  
2. National Transportation Safety Board letter dated Oct. 15, 2001 to Docket Management System

Dear Sir/Madam:

United Parcel Service Co. (UPS) requests an amendment to section 121.344(d)(1) of Title 14, Code of Federal Regulations (14 CFR). Section 121.344(d)(1) prescribes that, for all turbine-engine-powered transport category airplanes that were manufactured after October 11, 1991, the Flight Data Recorder Systems parameters listed in paragraph (a)(1) through (a)(34) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix M of this part by August 20, 2001.

The proposed amendment would revise the resolution requirements of Appendix M, specifically, parameters 12a Pitch Control(s) Position, 14a Yaw Control Position(s) and 16 Lateral Control Surface(s) Position for 767 airplanes. Our proposal is to add a new footnote to Appendix M, parameter 12a Pitch Control(s) Position, which states "For 767 series airplanes, resolution = 0.450% (0.088 deg.>0.039 deg.)". Next, we propose to revise Appendix M, parameter 14a Yaw Control Position(s), footnote 15, to add "For 767 series airplanes, resolution = 0.293% (0.088 deg.>0.060 deg.)". Finally, we propose to revise Appendix M, parameter 16 Lateral Control Surface(s) Position, footnote 17, to add "For 767 series airplanes, aileron resolution = 0.202% (0.087 deg.>0.086 deg.)".

The purpose of this proposed amendment is to provide permanent relief from the resolution requirements of Appendix M of section 121.344(d)(1). Special Federal Aviation Regulation (SFAR) No. 89 provides temporary relief from the regulation until August 18, 2003. UPS recognizes that the Federal Aviation Administration (FAA) is currently evaluating a petition from The Boeing Company (Boeing) regarding a similar amendment to the regulation for the 717, 757 and 767 airplanes. We believe that the FAA has already established a precedence for the requested changes. The precedence was established by the FAA when different standards were specified for certain parameters for Airbus airplanes.

In a letter dated May 22, 2001 from Boeing to the FAA Office of Rulemaking, Boeing requested that Appendix M be revised to reflect the resolution recording capabilities of the affected airplanes. Boeing also stated "...the resolution requirements should not be many orders of magnitude greater than the accuracy requirements." The National Transportation Safety Board (NTSB) concurred in a letter dated October 15, 2001 which provided comments to SFAR No. 89 and the May 22, 2001 letter from Boeing. The NTSB stated "...we are in general agreement with this statement...". The NTSB further stated "...the resolution requirements (of section 121.344, Appendix M) could be relaxed if it can be demonstrated that compliance would not be practical and the resolution could be maintained at least at a magnitude finer than accuracy. The May 22 letter from Boeing to the FAA clearly demonstrates that the current resolution recording capabilities of the 767 airplane far exceed an order of magnitude greater than the accuracy requirements.

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Based on the NTSB's position that the resolution be maintained at least at a magnitude finer than the accuracy requirement (+/- 2 deg. or 4 deg. total), the resolutions of the pertinent parameters could vary as much as .40 degrees (.10 x 4 deg.). The following table shows the required and actual resolutions of the pertinent parameters. As shown in the table, the magnitude of the actual resolutions of the pertinent parameters are already much finer than the level which the NTSB has stated that it is willing to accept.

| PARAMETER                           | RESOLUTION<br>REQUIRED BY<br>APPENDIX M | REQUIRED<br>MAGNITUDE<br>OF<br>RESOLUTION<br>(Times finer<br>than required<br>accuracy) | ACTUAL<br>RESOLUTION<br>OF BOEING<br>767<br>AIRPLANES | ACTUAL<br>MAGNITUDE<br>OF<br>RESOLUTION<br>(Times finer<br>than required<br>accuracy) | RESOLUTION<br>ACCEPTABLE<br>TO NTSB<br>(10 times<br>finer than<br>required<br>accuracy) |
|-------------------------------------|---|---|---|---|---|
| 12a Pitch<br>Control(s)<br>Position | .039 degrees                            | 102 x   | .088 degrees  | 45 x  | .40 degrees   |
| 14a Yaw<br>Control<br>Position(s)   | .060 degrees                            | 67 x  | .088 degrees  | 45 x  | .40 degrees   |
| 16 Lateral<br>Control<br>Surface(s) | .086 degrees                            | 46 x  | .087 degrees  | 46 x  | .40 degrees   |

Amending Appendix M of section 121.344(d)(1) to allow recording of the existing resolution capabilities of the affected airplanes is in the public interest. The proposed amendment will allow UPS to continue to operate its fleet of thirty-two (32) 767 airplanes without incurring additional modification cost to comply with the current rule. These costs would subsequently be passed on to consumers through higher shipping cost. The proposed amendment does not compromise the accuracies of the pertinent parameters and will provide an equivalent level of safety necessary to meet the intent of the FAA requirements for the recording resolution of Flight Data Recorder parameters.

Please contact either Tom Wagner at 502-329-6058 (e-mail: [tgwagner@ups.com](mailto:tgwagner@ups.com)) or Dale Davis at 502-329-6051 (e-mail: [dadavis@ups.com](mailto:dadavis@ups.com)) if there are any questions.

Sincerely,

  
Tony McBride  
Manager, Quality Assurance

TM:MA:jb

cc: Dale Davis  
Tom Wagner  
Bill Scott - FAA

Attachments

James G. Drazler  
Director  
Airplane Certification  
Commercial Airplanes Group

The Boeing Company  
P.O. Box 3707 MC 67-UM  
Seattle, WA 98124-2207

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FAA-01-9818-1

May 22, 2001  
B-H300-01-JGD-011



Office of Rulemaking (ARM-1)  
Department of Transportation  
Federal Aviation Administration  
800 Independence Avenue, Southwest  
Washington, DC 20591

Subject: FAR 121.344, Appendix M Resolution Exemption Request

Dear Sir/Madam:

Summary

Boeing requests that FAR 121, Appendix M be amended so that the Flight Data Recorder Systems (FDRS) resolution requirements take into account the accuracy requirements.

Boeing performed a parameter resolution audit on all analog signals on the 717/737/747-400/757/767/777/MD11/MD80/MD90 and DC10 FDRS to determine if the FDRS comply with FAR 121, Appendix M parameter resolution requirements. Boeing only reviewed the parameter resolutions of airplane models that were still in production after October 1991. Airplane models that were not in production at that time typically didn't have to meet the resolution requirements defined in FAR 121, Appendix M.

The audit confirmed that the 737/747-400/777/MD11/MD80/MD90 and DC10 FDRS parameter resolutions meet the FAA requirements. However, the audit also revealed that there are a few parameters on the 717/757 and 767 that do not meet the resolution requirements, but are near the FAA requirements.

Boeing requests that FAR 121, Appendix M be amended so that the FDRS resolution requirements take into account the accuracy requirements. That is, the resolution requirements should not be many orders of magnitude greater than the accuracy requirements. If the FAA determines that the proposed amendment request is not acceptable, then Boeing requests an exemption for the identified parameters on the 717/757 and 767 airplanes that do not meet the resolution requirements. The parameters identified nearly meet the FAA resolution requirements and Boeing believes they meet the intent of the FAA requirements.

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The following is Boeing's interpretation of resolution and accuracy, the FAR 121 Appendix M amendment request, and the parameter exemption request for 717/757 and 767 airplanes.



#### Boeing's Interpretation of Resolution and Accuracy

No definitions are given in FAR 121 for resolution and accuracy. Hence, Boeing had to assume a definition due to the variety of ways they could be defined. The following are the assumed definitions of resolution and accuracy utilized by Boeing and the justification for the assumptions.

#### Resolution Discussion

The investigator uses the resolution to convert the raw recorded data to usable engineering units. All specifications for a recording system should include the resolution to convert the raw recorded data. Boeing believes that the best meaning of resolution is the recorded word resolution, which is needed to convert the recorded raw data. The resolution needs to be small enough that it does not compromise the accuracy of the signal.

#### Resolution Definition:

Resolution is the smallest change in the recorded parameter, which is the least significant data bit recorded. The resolution facilitates the conversion of the recorded raw data to engineering units and should be such that it does not compromise the accuracy of the parameter (resolution should be approximately an order of magnitude finer than the required parameter accuracy).

#### Analog Accuracy Discussion

In FAR 121, appendix M, "sensor input" is indicated in the heading of the accuracy column in parenthetical notes. This note refers to the individual sensor but it would be appropriate to include the A-to-D conversion of the recorder system. ED-55, paragraph A1.8, defines recording accuracy such that "the recording system ... shall contribute no more than half of the values stated in the accuracy column of the relevant parameter table". This statement appears to be relevant only to analog parameter sources, to make sure the accuracy of the A-to-D conversion is always better than the sensor accuracy. Boeing believes that the analog accuracy should include the sensor through the recorded data and not apply to items upstream of the sensor. It is difficult to precisely determine the accuracy of the mechanical linkages.

#### Analog Accuracy Definition:

When an analog signal is input directly to the flight recorder system, the parameter accuracy applies only to the sensor through the recorded data and does not apply to items upstream of the sensor. In addition, the recording

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system from the sensor output through the recorded data shall contribute no more than half of the values stated in the accuracy column of the relevant parameter.



#### Digital Accuracy Discussion

The FDRS receives digital data from many systems. The system that originally acquires or computes the data controls the accuracy of the data. By necessity, this system acquires or computes the data with enough accuracy to meet the needs of the system itself. Then any other systems receiving this data (e.g. the FDRS) in a digital format can acquire the data with the full resolution provided by the originating system, or some lesser resolution. However, the accuracy of the signal received by these systems is fixed. The accuracy of a digital signal should not need to be any greater than the accuracy required by the originating system. In FAR 121, appendix M the accuracy requirement for some of the parameters is "as installed" and the same terminology could be used for digital signals. Boeing believes that the accuracy required by the source of digital data is sufficient for the FDRS.

#### Digital Accuracy Definition:

When a digital data bus provides the input signal to the flight recorder system, the accuracy requirement is "as installed" (equal to the accuracy requirement of the originating system that digitizes the data).

It would be helpful and provide uniform understanding if the FAA considered including these definitions in FAR 121 and AC 20-141.

#### FAR 121, Appendix M Amendment Request

The resolution specified for some parameters seems to be overly restrictive. For example the resolution required for control column (parameter 12) is 0.2% of full range. The movement of the control column is 11° forward to 8.75° aft, for a total operating range of 19.75°. The required resolution would be .2% of 19.75°, which is .0395°. The required accuracy of the same parameter is +/-2° or 4°. A resolution of .0395° is more than 100 times finer than the required accuracy of 4°. Using the above definition of resolution such that the resolution should not compromise the accuracy could be an appropriate way of establishing the resolution requirement for each parameter. Then the resolution column in the appendix M could be removed. If it is determined that the resolution column needs to stay in appendix M, then when the accuracy is defined in degrees then the resolution should be in the same units and not more than an order of magnitude finer than the accuracy. This will reduce the potential of having a resolution that is much finer than required.

The following are areas in appendix M that should be updated. If the following changes were made to appendix M the parameters identified in the resolution

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exemption request would comply with the requirements and the resolution exemption would not need to be granted.



- 5, Normal Acceleration (Vertical): The accuracy required is +/-1% of full range (+6 to -3g), which equates to +/-0.09g. A resolution that is an order of magnitude finer than the accuracy is 0.018g. The same resolution that is in Appendix B should be retained "0.01g" not "0.004g"
- 12a, Pitch Control: Accuracy should be the same as other primary controls (12b through 17) "+/-2°" not "+/-2 %"
- 19, Pitch Trim: Accuracy should be the same as the other surface position requirements (parameters 15, 16, and 17) "+/-2°" not "+/-3 %"
- 87, Ground Spoiler/Speed Brake: Accuracy should be consistent with parameter 23, Ground Spoiler/Speed Brake "+/- 2°" not "+/- 5 %"
- 12 through 17, Primary Controls and Surfaces; 19, Pitch Trim; 23 and 87, Ground Spoiler/Speed Brake: Resolution should be only an order of magnitude finer than accuracy and in the same units "0.4°" not "0.2 %"
- 85, Trailing Edge Flap/Cockpit Control: Accuracy should be consistent with parameter 20, Leading Edge Flap/Cockpit Control "+/- 3°" not "+/- 5 %"
- 86, Leading Edge Flap/Cockpit Control: Accuracy should be consistent with parameter 21, Leading Edge Flap/Cockpit Control "+/- 3°" not "+/- 5 %"
- 20 and 85, Trailing Edge Flap/Cockpit Control; 21 and 86, Leading Edge Flap/Cockpit Control: Resolution should be only an order of magnitude finer than accuracy and in the same units "0.6°" not "0.3 %"
- 26, Radio Altitude: There is no resolution requirement below 500ft "1ft below 500ft" should be added
- 56, Multi-function/Engine Alerts Display Format: The remarks indicated that "off, normal, fail, and the identity of display pages for emergency procedures, need not be recorded". It is believed that some text was excluded from the remarks and should be similar to the remarks in EUROCAE MOPS for Flight Data Recorder System (ED-55) "e.g., off, normal, fail, and the identity of display pages for emergency procedures, checklist, information in checklists and procedures need not be recorded"
- 82, Trim Control-Pitch; 83, Trim Control-Roll; 84, Trim Control-Yaw; 88, Control Forces: Resolution should be only an order of magnitude finer than the accuracy "1%" not "0.2%"

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Exemption Request

Boeing requests an exemption from FAR 121, appendix M resolution requirements and to be allowed to record the existing resolution for the following parameters.

| Model   | Parameter                          | Existing Resolution | Required Resolution |
|---------|------------------------------------|---------------------|---------------------|
| 757     | Control Column                     | .082                | .044                |
| 767     | Control Column                     | .088                | .039                |
| 757/767 | Rudder Pedal                       | .088                | .060                |
| 757     | Stabilizer Position                | .068                | .046                |
| 767     | Stabilizer Position                | .064                | .043                |
| 757/767 | Spoiler/Speedbrake Handle Position | .352                | .156                |
| 767     | Aileron Position (Inboard)         | .087                | .086                |
| 717     | Vertical Acceleration              | .00458              | .00400              |

The 757 production Control Column and Rudder Pedal installations were revised in 1991 to increase the parameter to sensor ratio to comply with the resolution requirement for new deliveries. A similar change was done in production on the 767 starting in 1999.

The 757 and 767 Stabilizer and Speed Brake Handle Positions do not meet the resolution requirements because only ten bits are used to record the analog source. The standard production configuration after 1991 obtained digital Stabilizer and Speed Brake Handle Position from the FCC/MCP. Assuming the definitions as we have defined above, the digital FCC/MCP data is sufficient to meet the requirements. However, some airlines have chosen a different configuration that uses the analog Stabilizer and Speed Brake Handle signals. Most 757 and 767 delivered today record both the analog and digital Stabilizer Positions.

The 767 Inboard Aileron Position does not meet the required resolution because only ten bits are used to record the parameter. However, the outage is very small (0.001 degree), and the data is supplemented with Outboard Aileron Position which meets all requirements.

The current resolution on the 717 Vertical Acceleration is .00458. The accuracy requirement for this parameter is +/-1% of full range (+6 to -3g), which equates to +/-0.09g. To obtain an order of magnitude resolution the requirement would be 0.018g and the current resolution is much finer.

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The existing resolution of the above parameters does not compromise the integrity of the signal and should not hinder any accident investigation. It will allow airlines to use their existing parameter installations and not require costly system revisions that will add very little benefit.



Sincerely,

A handwritten signature in cursive script, appearing to read 'Jim Draxler'.

Jim Draxler  
Director, Airplane Certification,  
Regulatory Requirements & Compliance

cc: Mr. Stephen VanTrees



144180



Office of the Chairman

## National Transportation Safety Board

Washington, D.C. 20594

OCT 15 2001

Docket Management System  
U.S. Department of Transportation Dockets  
Room Plaza 401  
400 Seventh Street, S.W.  
Washington, D.C. 20590-0001

Reference: Docket Number FAA-2001-10428 - 5

Dear Sir/Madam:

The Safety Board has reviewed Special Federal Aviation Regulation (SFAR) No. 89 "Digital Flight Data Recorder [DFDR] Resolution Requirements" dated August 22, 2001, and concurs with the intent of the regulatory change to provide temporary relief to the operators of specified airplanes from the FDR resolution requirements of appendix M for certain parameters.

Because this SFAR was the direct result of a petition for exemption from the Boeing Company (Boeing), the Safety Board believes that its comments would be most effective if specifically directed toward the Boeing petition. To that end, the Safety Board requested and received a copy of the May 22, 2001, letter from Boeing to the Federal Aviation Administration (FAA) Office of Rulemaking that requested the exemption from FAR 121.344, appendix M resolution requirements for certain parameters on some Boeing airplane models. In reviewing this letter, the Safety Board found a number of exemption requests, regulation updates, and position statements that go beyond what is addressed by this SFAR. The Safety Board believes that some of the positions and opinions expressed in that letter could significantly influence subsequent DFDR rulemaking. Therefore, the Safety Board offers the following comments to the May 22, 2001, letter from Boeing that requests an exemption from FAR 121.344, appendix M resolution requirements.

The Boeing letter requests that FAR 121.344, appendix M be amended to take into account parameter accuracy requirements when determining the resolution requirement. The letter states "...the resolution requirements should not be many orders of magnitude greater than the accuracy requirements." Although we are in general agreement with this statement, the Boeing letter goes on to say that if their definition of resolution were followed there would be no need for the FAR to list a minimum resolution requirement. The Safety Board does not agree with this position and believes that the resolution requirements should remain in the rules as written.

Parameter resolution can impact the quality of digital data; too coarse a resolution could result in a significant event going undetected. There is an economic incentive to use coarse resolution: finer resolution equates to increased memory requirement, and increased memory equates to increased recorder costs. Therefore, the rules must retain the explicit resolution requirements so as to minimize the opportunity for any misinterpretation that would reduce data quality to an unacceptable level.

The Safety Board recognizes that regulations must be written in terms that can be uniformly applied and, as a result, may not be directly applicable in all instances. This circumstance is especially true for FDR rules where detailed technical specifications must be crafted into rule language that references recognized technical standards (such as EUROCAE document ED-55) while attempting to harmonize with the regulatory requirements of other nations. Because of this need, there will be occasions when rule language will result in requirements that are more stringent than necessary.

With the exception of vertical acceleration on the Boeing 717, all of the parameters for which Boeing is requesting an exemption involve flight controls for which the resolution requirements are based on a percentage of the parameter's full range of travel. Because the range of travel for these parameters varies greatly from one model aircraft to another, it would not be practical to express the range of travel for all aircraft. Therefore, the resolution requirements are presented as a percentage of the parameter's full range of travel. As a result, when the full range of a parameter is relatively short, the resolution requirements may be more stringent than necessary. When this situation arises, the minimum resolution for a given parameter should be evaluated to determine if regulatory relief could be granted and the accuracy requirements maintained. With this in mind, the Safety Board has reviewed the Boeing request for exemption from the FDR resolution requirements in FAR 121.344, appendix M, and with the exception of vertical acceleration for the 717, found no objection to granting the requested exemptions.

With regard to parameter vertical acceleration for the 717, it is not clear why the minimum resolution requirements cannot be met. A review of the 717 FDR system documentation indicates that the parameter vertical acceleration is being written as a 12-bit word, which is normally more than sufficient to meet the minimum resolution requirements of "0.004g" (for example, on MD-80s, vertical acceleration is recorded in a 12-bit word and the resolution is 0.0022895g).

The Boeing letter also contains a definition for "Recorder Resolution." Although we are in general agreement with this definition, we believe that the reference to "facilitating the conversion of recorded data" could be misinterpreted when complex conversion algorithms are required. Therefore, the Safety Board suggests the following modified version:

**Recorder Resolution**

Resolution is the smallest change in the recorded parameter, which is the least significant data bit recorded, and should be such that it does not compromise the accuracy of the parameter (resolution should be approximately an order of magnitude finer than the required parameter accuracy).

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The Boeing letter goes on to provide additional discussion on digital data accuracy, which includes the following statement: "The accuracy of a digital signal should not need to be any greater than the accuracy required by the originating system." Although this statement is true for many digital parameters, there are cases where it does not apply. An example would be the flight control surface position on early model Boeing 757 and 767 airplanes, which recorded the flight control position data displayed to the crew via the Engine Indication and Crew Alerting System (EICAS). These data were heavily filtered and smoothed so as to produce a clear presentation on the cockpit display. However, these filtered data lacked sufficient accuracy to allow for a detailed analysis of the flight control position time history during dynamic events. To correct this problem, appendix M now includes the following statement: "The recorded values must meet the designated range, resolution, and accuracy requirements during dynamic and static conditions." Therefore, the Safety Board does not agree with the following Boeing definition of digital data accuracy:

**Digital Accuracy Definition**

When a digital data bus provides the input signal to the flight recorder system, the accuracy requirement is "as Installed" and (equal to the accuracy requirement of the originating system that digitizes the data).

The Boeing letter also identified 11 areas in appendix M for update. The following discussion gives the Safety Board position on Boeing's proposed updates:

**Parameter 5, Normal Acceleration**

*Boeing Position:* The accuracy required is  $\pm 1\%$  of full range (+6 to -3g), which equates to  $\pm 0.09g$ . A resolution that is an order of magnitude finer than the accuracy is 0.018g. The same resolution that is in appendix B should be retained "0.01g" not "0.004g."

*Safety Board Position:* The parameters vertical, lateral, and longitudinal accelerations are unique in that their resolution requirement can at times be more significant to the investigation than their absolute value. For example, investigators often use the momentary spikes in the acceleration values to determine specific events, such as an aircraft departing the paved surface of the runway, brake release, or the onset of an abrupt maneuver. In these instances the absolute value of the "g" spike is less significant than the detection of the event. Too coarse a resolution and these critical events could go undetected. Therefore, the Safety Board concludes that the resolution of these parameters should not be changed. Boeing and other aircraft manufacturers typically assign a 12-bit word to record vertical acceleration, which is more than adequate to meet the FAR resolution requirements.

**Parameter 12a, Pitch Control**

*Boeing Position:* Accuracy should be the same as other primary controls (12b through 17) " $\pm 2^\circ$ " not " $\pm 2\%$ ."

*Safety Board Position:* This appears to be a typo and should be corrected during the current rulemaking effort.

**Parameter 19, Pitch Trim**

*Boeing Position:* Accuracy should be the same as the other surface position requirements (parameters 15, 16, and 17) "+/- 2°" not "+/- 3%."

*Safety Board Position:* The sensitivity of the pitch trim/stabilizer requires a higher accuracy. A resolution of "+/- 3%" also harmonizes the FAR with ED-55.

**Parameter 87, Ground Spoiler/Speed Brake**

*Boeing Position:* Accuracy should be consistent with parameter 23, Ground Spoiler/Speed Brake "+/- 2°" not "+/- 5%."

*Safety Board Position:* Parameter 23 is less stringent as it applies to existing aircraft and aircraft under contract to be constructed when the rule was issued. Parameter 87 applies to aircraft manufactured after August 19, 2002, and harmonizes with ED-55 and, therefore, should not be changed.

**Parameters 12 through 17, Primary Controls and Surfaces; 19, Pitch Trim; and 23 and 87, Ground Spoiler/Speed Brake**

*Boeing Position:* Resolution should be only an order of magnitude finer than accuracy and in the same units "0.4°" not "0.2%."

*Safety Board Position:* FAR 121.344, appendix M should not be changed, but the resolution requirements could be relaxed if it can be demonstrated that compliance would not be practical and the resolution could be maintained at least at a magnitude finer than the accuracy.

**Parameter 85, Trailing Edge Flap/Cockpit Control**

*Boeing Position:* Accuracy should be consistent with Parameter 20, Leading Edge Flap/Cockpit Control "+/- 3°" not "+/- 5%."

*Safety Board Position:* We agree with the Boeing position; the wording change would harmonize the FAR with ED-55.

**Parameter 86, Leading Edge Flap/Cockpit Control**

*Boeing Position:* Accuracy should be consistent with Parameter 20, Leading Edge Flap/Cockpit Control "+/- 3°" not "+/- 5%."

*Safety Board Position:* We agree with the Boeing position; the wording change would harmonize the FAR with ED-55.

**Parameters 20 and 85, Trailing Edge Flap/Cockpit Control; and 21 and 86, Leading Edge Flap/Cockpit**

*Boeing Position:* Resolution should be only an order of magnitude finer than accuracy and in the same units "0.6°" and not "0.3%."

*Safety Board Position:* FAR 121.344, appendix M should not be changed, but the resolution requirements could be relaxed if it can be demonstrated that compliance would not be practical and the resolution could be maintained at least at a magnitude finer than the accuracy.

**Parameter 26, Radio Altitude**

*Boeing Position:* There is no resolution requirement below 500 ft; "1 ft below 500 ft" should be added.

*Safety Board Position:* We agree with the Boeing position; "1 ft below 500 ft" should be added; this addition would also harmonize the FAR with ED-55.

**Parameter 56, Multi-function/Engine Alerts Display Format**

*Boeing Position:* The remarks section contains the following notation: "off, normal, fail, and the identity of display pages for emergency procedures, need not be recorded." It is believed that some text was excluded from the remarks and should be similar to the remarks in EUROCAE MOPS for Flight Data Recorder Systems (ED-55) "e.g., off, normal, fail, and the identity of displayed pages for emergency procedures checklist. Information in checklists and procedures need not be recorded."

*Safety Board Position:* We agree with the Boeing position; the wording change would harmonize the FAR with ED-55.

**Parameters 82, Trim Control-Pitch; 83, Trim Control-Roll;  
84, Trim Control-Yaw; 88, Control Forces**

*Boeing Position:* Resolution should be only an order of magnitude finer than the accuracy "1%" not "0.2%."

*Safety Board Staff Position:* FAR 121.344, appendix M should not be changed, but the resolution requirements could be relaxed if it can be demonstrated that compliance would not be practical, and the resolution could be maintained at least at a magnitude finer than the accuracy.

The Safety Board is very interested in maintaining the quality of FDR data and will give its full support to this rulemaking effort to ensure that the Board's position on this important subject is clearly understood.

Sincerely,



Marion C. Blakey  
Chairman